

WHAT IS CLAIMED IS:

1. A focus monitoring method used for pattern formation of a semiconductor device, characterized in that
light is directed onto a photomask by non-telecentric illumination obtained by controlling a shape of an opening of an illumination aperture,
5 and such a characteristic is utilized to perform focus monitoring that a pattern image of said photomask formed by said illumination is moved in a direction perpendicular to an optical axis when an image-forming plane is moved in a direction of said optical axis.
2. The focus monitoring method according to claim 1, wherein a mark pattern of a box-in-box type having an outer box pattern and an inner box pattern is transferred onto a photoresist, and a relative displacement of said outer box pattern and said inner box pattern transferred onto said
5 photoresist is detected, to perform focus monitoring.
3. The focus monitoring method according to claim 2, wherein said non-telecentric illumination is used for exposure of at least one of said outer box pattern and said inner box pattern.
4. The focus monitoring method according to claim 3, wherein
said non-telecentric illumination is used for exposure of both of said outer box pattern and said inner box pattern,
a first illumination aperture having an opening only on one side of a
5 meridian plane set as a border is used at the time of exposure of said outer box pattern, and
a second illumination aperture having an opening only on the other side of the meridian plane set as a border is used at the time of exposure of said inner box pattern.
5. The focus monitoring method according to claim 4, wherein
one of a circular illumination apperture stop, an annular

0
9
8
7
6
5
4
3
2
1
0

illumination apperture stop and a quadruple illumination apperture stop, with an opening left only on one side of the meridian plane set as a border, 5 is used for said first illumination aperture, and

one of a circular illumination apperture stop, an annular illumination apperture stop and a quadruple illumination apperture stop, with an opening left only on the other side of the meridian plane set as a border, is used for said second illumination aperture.

6. The focus monitoring method according to claim 2, comprising:
a first exposure step exposing said photoresist to one of said outer 5 box pattern and said inner box pattern;

a second exposure step exposing said photoresist to the other one of 5 said outer box pattern and said inner box pattern; and

a development step developing said photoresist after said first and second exposure steps.

7. The focus monitoring method according to claim 2, comprising:
a first exposure step exposing said photoresist to one of said outer 5 box pattern and said inner box pattern;

a first development step developing said photoresist after said first 5 exposure step;

a second exposure step exposing said photoresist to the other one of said outer box pattern and said inner box pattern; and

a second development step developing said photoresist after said 5 second exposure step.

8. A focus monitoring apparatus used for pattern formation of a semiconductor device, comprising:

an illumination optical system illuminating a photomask on which a pattern is formed with exposure light; and

5 a projection optical system projecting an image of the pattern of said photomask onto a photosensitive body,

said image of the pattern of said photomask, formed by directing

10

non-telecentric illuminating light obtained by controlling a shape of an opening of an illumination aperture included in said illumination optical system onto said photomask, being configured to move in a direction perpendicular to an optical axis when an image-forming plane is moved in a direction of said optical axis.

9. A method of manufacturing a semiconductor device, characterized in that the focus monitoring method according to claim 1 is used.

2025 RELEASE UNDER E.O. 14176